

Specification

Paragraphs in the Summary referring to objects of the invention have been deleted.
Paragraph 22 has been amended to keep the Summary in better agreement with the claims.
No new matter has been added.

Claims

The applicant thanks the examiner for allowing claims 35-41. Independent claims 1, 10, 15, 19, 25 and 42 along with several dependent claims were rejected under 35 U.S.C. 103 (a) as being unpatentable over Swenson et al. in view of Schmidt. While Swenson teaches a helical channel formed on the outside of a mixer, it does not disclose or suggest any embodiment where the helical groove is formed on an internal surface of the mixer. Schmidt teaches a bushing in a manifold with an outlet approximately perpendicular to the melt channel, and the examiner suggested that it would be obvious to combine the two teachings to obtain the invention of the above referenced claims.

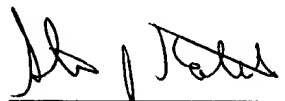
Claims reciting the helical groove on the *outside* of the mixer have been cancelled. The remaining claims, as amended, all recite the helical groove on an *internal* surface of the mixer, which is not taught in the references cited. Independent claim 19 originally recited this limitation, and the other remaining independent claim, 42, has been amended to include that limitation. The remaining dependent claims all relate to one of those independent claims.

The amended claims now overcome examiner's 103(a) rejection based on a combination of Swenson and Schmidt. The rejections based on 35 U.S.C. 112 are moot since the claims to which they pertained have been cancelled.

The claims, as amended, now overcome the examiner's rejections, and the application is now in condition for allowance.

Respectfully submitted,
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by



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Application No.: 09/822,537
Title: Melt Flow Mixer in an Injection Molding System
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Version with Marking to Show Changes Made

Specification paragraph:

[0022] [The foregoing objects are achieved by providing a] A mixer is located in a melt channel of an injection molding system, preferably around a valve stem or other flow obstruction[,] where the melt navigates a change in flow direction and flows around the obstruction. The mixer has an inlet communicating with the melt channel, and an exit approximately perpendicular to the inlet. One preferred embodiment comprises a cylindrically tapered insert with a helical or spiral groove disposed on [its outer] an inner surface. The groove is preferably formed to be decreasing in depth and width, so as the melt flows into the groove, it gradually spills out of the groove. As the melt travels through the helical groove, it is mixed and changes from circular flow to annular flow [direction in the hot runner manifold]. The helical groove helps direct the melt around the back of the mixer which helps to eliminate stagnation points behind the flow obstruction while also providing uniform annular flow of the melt.

Claims:

19. (amended) In an injection molding system, a flow mixer [in the stream of a flowing melt] comprising:

a mixer bushing inserted in a bore of a hot runner manifold, the mixer bushing having a flow inlet communicating with a melt channel in the manifold, an exit oriented approximately perpendicular to the flow inlet, and an internal surface between the flow inlet and exit on which a helical channel is formed to communicate a flowing melt from the inlet to the exit;

a valve stem slidably inserted in said mixer bushing coaxially with the helical channel [said valve stem being operatively connected to a piston at a top distal end and terminating adjacent a nozzle outlet at a bottom distal end];

[a helical channel formed on an inside surface of said mixer bushing, said helical channel communicating said flowing melt from a melt channel of said hot runner manifold to a flow exit, said flow exit being approximately perpendicular to said melt channel;]

wherein in use, said flowing melt is transitioned from circular flow to annular flow as

it travels from said [melt channel] inlet to said exit.

20. (amended) The flow mixer of claim 19, wherein said helical channel reduces in cross-sectional area [as the melt flows] in a direction from said [melt channel] inlet to said exit.

21. The flow mixer of claim 19 wherein said [inside] internal surface [of said mixer housing] is tapered such that [the] a gap between said helical channel and said valve stem [inside surface is] gradually [increasing] increases in [the] a direction from said inlet to said outlet [of the melt flow].

23. The flow mixer of claim 19, further comprising a locating pin for maintaining alignment of said [helical channel] inlet to said melt channel.

24. The flow mixer of claim 19, further comprising a piston housing rigidly affixed to said mixer bushing, said piston housing containing a piston connected to a top distal end of said valve stem, said piston operative inside said piston housing to move said valve stem [in an up and down motion] to start and stop flow of the melt through a nozzle outlet.

42. (amended) In an injection molding system having a heated hot runner manifold with a primary melt channel formed therein, an injection nozzle comprising;

a mixer bushing having [a helical channel with] a flow inlet, [and] an exit [formed therein] oriented approximately perpendicular to the flow inlet, and an internal surface between the flow inlet and exit on which a helical channel is formed;

a nozzle body [having a melt channel formed therein and] co-axially located around said mixer bushing[, said] and having a melt channel in fluid communication with said flow inlet and said primary melt channel [in fluid communication with said melt channel]; and

a movable valve stem inserted co-axially [in] through said helical channel for [selectably] selectively starting and stopping a flowing melt.

43. (amended) The injection nozzle of claim 42, wherein a gap between said helical channel and said valve stem gradually increases [as the melt travels] in a direction from said flow inlet to said exit.

44. (amended) The injection nozzle of claim 42, further comprising a locator affixed between said nozzle [housing] body and said mixer bushing thereby maintaining [the] alignment of said melt channel to said flow inlet.